Correlates of Nonadherence to Hypertension Treatment in an Inner-City Minority Population

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A B S T R A C T

Objectives. Adherence to treatment is a key factor in achieving blood pressure control among hypertensives. We examined correlates of nonadherence to hypertension treatment in an inner-city minority population.

Methods. Subjects (n = 202) were interviewed as part of a case-control study of severe, uncontrolled hypertension conducted in two New York City hospitals in 1989–91. All subjects were African American or Hispanic. Self-reported nonadherence to drug treatment for hypertension was measured using a five-item scale, and the sample was dichotomized as more (n = 87) or less (n = 115) adherent. Multiple logistic regression analysis was used to adjust for demographic and other covariates.

Results. Nonadherence was associated with having blood pressure checked in an emergency room (adjusted odds ratio [OR] =7.9; 95% confidence interval [CI] =1.75, 35.77; *P* < .01), lack of a primary care physician (adjusted OR = 2.9; 95% CI = 1.37, 6.02; *P* < .01), current smoking (adjusted OR = 2.4; 95% CI = 1.10, 5.22; *P* = .03), and younger age (adjusted OR = 1.03, 95% CI = 1.00, 1.06; *P* = .03).

Conclusions. Changing the locus of care for hypertension from emergency rooms to primary care physicians may improve adherence to hypertension treatment in minority populations. (*Am J Public Health.* 1992;82:1607–1612)

Introduction

Steady improvement in blood pressure control in the US population[1-4] has followed a successful series of randomized controlled clinical trials of hypertension treatment,[5] the development of a broad pharmacological armamentarium, and the dissemination of information through the National High Blood Pressure Education Program.[6] Improved control of hypertension, in turn, has contributed to reductions in incidence rates for stroke and ischemic heart disease.[7-9] Despite these gains, poorly controlled hypertension remains a health problem of major proportions, particularly among minority populations, the poor, those with lower levels of education, and those with limited access to medical care.[10-13] The major adverse clinical outcomes of hypertension, namely ischemic heart disease, stroke, and renal failure, continue to have substantially higher incidence rates in African Americans compared with Whites.[9,14,15] Increasing the prevalence of blood pressure control among hypertensives to at least 50% is one of the health promotion and disease prevention objectives set forth in *Healthy People 2000.*[16]

A generally accepted public health approach to achieving blood pressure control involves a sequential model, the steps being detection, patient awareness of the diagnosis, treatment, adherence, and blood pressure control.[17,18] Of these, adherence to treatment has been widely recognized as key to controlling blood pressure.[19] In two recent studies of hypertensive emergency and urgency—the most severe forms of uncontrolled hypertension—we found that 85% to 98% of cases were previously diagnosed and treated for hypertension.[11,13] Thus, nonadherence to a treatment regimen rather than failure to diagnose or initiate treatment for hypertension was the most important antecedent of poor blood pressure control in the predominantly minority populations studied. In the current study, we examined correlates of adherence and nonadherence to hypertension treatment.

Methods

Setting and Subjects

The study was conducted between October 1989 and June 1991 at the Presbyterian Hospital and Harlem Hospital Center in New York City. Presbyterian Hospital is the only acute care hospital in northern Manhattan, an area with a population of approximately 200 000 people, of whom approximately two thirds are Hispanic. Harlem Hospital serves central Harlem, an area with a population of 110 000 that is almost entirely African American. Subjects were enrolled in a case-control study of hypertensive emergency and urgency. Cases were patients with incidents of hypertensive emergency or hypertensive urgency, and controls were hypertensive patients with other acute conditions who were admitted to the hospital or were treated in the emergency

room and released. Examples of these other conditions include gastroenteritis, muscle spasm, allergy, backache, hernia, and otitis. Hypertension was defined as present if the patient was on drug treatment for hypertension or gave a history of having hypertension.

Eligible subjects were identified on a daily basis from admission logs both in the emergency room and for the medical and surgical services at the two hospitals. Subjects were excluded if they were under 21 years of age or pregnant. Five eligible cases and six eligible controls refused consent for the study; in no instances did physicians refuse permission for the research assistants to screen and attempt to enroll the patient. A total of 210 subjects were interviewed, of whom all but three (two non-Hispanic Whites and one Native American) were African American or Hispanic. These three subjects were excluded from analysis. One French-speaking Haitian Black subject was included since the research assistant spoke fluent French. Thus, data from 207 subjects (93 cases, 114 controls) were analyzed. Additional details about the study population have been published elsewhere.[13]

Data Collection

Data were collected by trained research assistants using structured patient interview and chart abstraction forms. Interview forms were available in Spanish and English, and the research assistant at Presbyterian Hospital, where all the Hispanic patients were seen, was fluently bilingual. All interview data were obtained at the time of the emergency room visit or during the hospital admission. This study was approved by the Institutional Review Boards of Columbia-Presbyterian Medical Center and the Harlem Hospital Center, and informed consent was obtained from all subjects.

Measurements

Clinical data were obtained from the chart. Demographic information, educational level, employment, marital status, health service utilization data, cigarette smoking habits, previous diagnosis and treatment of hypertension, recent alcohol-related problems, and use of illicit drugs were determined by interview.

Adherence to a blood pressure medication regimen was assessed using a five-item compliance scale derived from the four-item scale developed by Morisky et al.[20] Based on preliminary studies in our population, we made minor modifications in the wording of the four yes/no questions

in the scale of Morisky et al. to read as follows: Do you ever forget to take your high blood pressure pills? Are you ever careless in taking your pills? Do you ever miss taking your pills when you are feeling better? Do you ever miss taking any of your pills because you are feeling sick? To these we added a fifth question: Do you ever miss taking your high blood pressure medication for any reason? This scale was scored as one point for each positive response. This scale was previously reported to have predictive validity in that it was able to discriminate levels of hypertension control[20] and to discriminate cases of hypertensive emergency or urgency from hypertensive controls.[13] Cronbach's coefficient alpha,[21] a measure of the internal consistency of the scale, was .71 for the 202 subjects with complete data for all five items. Morisky et al. reported Cronbach's alpha of .61 for their four-item scale.[20]

The interview also included a series of questions regarding how much blood pressure medicine the subject took in a series of specified time periods before the day of admission or the index visit to the emergency room. The time referents for these questions were the prior day, week, month, and 6 months. The response set was "all or nearly all," "three quarters," "half," "a quarter," "none or nearly none," and "don't know." Cronbach's alpha for these five questions was .92 but should not be strictly interpreted because of the nested nature of the time referents.

Subjects were asked if there was a specific physician they identified as their personal or primary doctor. Subjects were classified as having a primary physician if they answered yes to this question (n = 133) or as not having a primary physician if they responded no (n = 69). There were no subjects who did not know or did not respond to this question. With regard to who checked the subject's blood pressure most of the time, subjects were classified as getting blood pressure checks in the emergency room (n = 24) versus all other responses (physician, nurse in a physician's office, visiting nurse, friend or relative, self) (n = 175); three subjects did not answer. With regard to who prescribed the blood pressure medication, subjects were classified as getting prescriptions from physicians in an emergency room (n = 19) versus all other sources (personal, primary, or private physician; different physicians in a clinic; different physicians in different offices) (n = 183); there were no missing data for this question.

Subjects were defined as current cigarette smokers if they reported having smoked at least 100 cigarettes in their lifetime and smoking one or more cigarettes per day at the time of admission to the hospital.[22] For the 81 subjects who reported consuming any alcohol in the previous year, the number of alcohol-related problems during that period was ascertained using 41 questions from the 1988 Health Interview Survey (Hyattsville, Md: National Center for Health Statistics). Complete data were obtained from 78 subjects. Acceptable detection rates for these questions have been reported.[23] We assumed that subjects reporting no alcohol consumption during the previous year had no alcohol-related problems. The interview also included questions on the use of illicit drugs for several categories of drugs (marijuana, cocaine, crack, heroin, methadone, and other drugs) during the previous year.

Statistical Analyses

The compliance scale was scored so that a higher score represented a lower level of adherence. To address the nonnormality of this distribution, we dichotomized the 202 subjects as close to the median as possible, resulting in groups scoring 0 to 1 (more adherent, n = 87) and 2 to 5 (less adherent, n = 115). Bivariate associations with adherence were tested using the χ^2 statistic for categorical independent variables and the t test for continuous variables. Use of a continuity correction for tables with fewer than five subjects in the smallest cell did not materially affect the odds ratio or the test statistic, and results are reported without this correction. Multiple logistic regression models were used to calculate adjusted regression coefficients, and odds ratios (ORs) and confidence intervals (CIs) were calculated from these coefficients.[24] The final logistic regression model included age (continuous), sex, education (less than high school graduate vs high school graduate or more), race/ethnicity (African American vs Hispanic), current smoking, alcohol-related problems (one or more vs none), illicit drug use in the past year, health insurance (any vs none), and whether the subject had a primary care physician. Adjustment for additional variables, including employment, marital status, and site of data collection (Presbyterian Hospital vs Harlem Hospital) changed the odds ratios only slightly, and these variables were not included in the final models. Multiple linear regression analyses in which the compliance score was repre-

TABLE 1—Frequency Distribution of Scores on the 5-Item Compliance Scale in 202 Hypertensive Subjects, New York City, 1989 to 1991		
Positive Items, No.	Subjects	
	No.	%
0	67	33.2
1	20	9.9
2	52	25.7
3	42	20.8
4	20	9.9
5	1	0.5

Note. A higher score indicates a lower level of adherence to treatment regimen.

TABLE 2—Selected Demographic Characteristics of Less Adherent and More Adherent Hypertensive Subjects, New York City, 1989 to 1991			
	Less Adherent (n = 115)	More Adherent (n = 87)	P Value
Age, y (mean ± SD)	54.7 ± 11.5	59.8 ± 11.8	<.01
Age range, y	25–76	24–78	
Male, %	47.8	31.0	.02
Race or ethnicity, %			.53
Hispanic	43.5	39.1	
African American	56.5	60.9	
Less than high school education, %	66.1	72.4	.34
Currently employed,[a] %			
Full time	33.0	14.9	<.01
Part time	4.3	4.6	.93
Unemployed	62.6	80.5	<.01
Marital status,[b] %			
Married	27.8	25.3	.66
Divorced or separated	34.8	28.7	.34
Widowed	11.3	23.0	.03
Never married	25.2	23.0	.69
Did not respond	0.9	...	
Place of interview, %			.57
Presbyterian Hospital	59.1	55.2	
Harlem Hospital	40.9	44.8	
Current cigarette smoker, %	32.2	16.1	< .01
One or more alcohol-related problems, %	17.7	7.0	< .05
Illicit drug use in the previous year, %	16.5	10.3	.21
Status as case or control, % cases	60.0	24.1	< .0001

[a]The overall test for the 2 × 3 table for employment status (full time, part time, not employed) yielded $\chi^2 = 8.68$, $df = 2$, $P = .013$.
[b]The overall test for the 2 × 4 table for marital status yielded $\chi^2 = 4.91$, $df = 3$, $P = .18$.

sented as a continuous variable produced results that did not differ materially from the logistic regression analyses, and only results from logistic regression analyses are presented. Subgroup analyses were performed by stratifying subjects according to whether they were cases or controls in the original case-control study and by fitting similar multiple logistic regression models within each stratum. Logistic regression analyses were performed using SAS-PC.[25] All other analyses were performed using SPSS/PC+.[26]

Results

The frequency distribution of scores on the adherence scale is shown in Table 1. In bivariate analyses of demographic variables (Table 2), younger age, male sex, and unemployment were associated with nonadherence. In a multiple logistic regression model including age, sex, education, race/ethnicity, employment, and marital status, however, only younger age was significantly associated with nonadherence (adjusted OR = 1.03, 95% CI = 1.00, 1.06, P = .03). Lack of health insurance was not significantly associated with nonadherence in bivariate (Table 3) or multivariate analyses.

There were three variables describing the pattern of medical care for hypertension: whether the subject had his or her blood pressure checked in an emergency room, whether the subject lacked a primary care physician, and whether the subject received prescriptions for blood pressure medications in an emergency room. All three variables were strongly associated with nonadherence in bivariate analyses (Table 3). The associations of each of these variables with nonadherence were

then tested in separate multiple logistic regression models in which we adjusted for age, sex, education, race/ethnicity, health insurance status, current cigarette smoking, one or more alcohol-related problems, and illicit drug use in the previous year. Nonadherence was associated with having blood pressure checked in an emergency room (adjusted OR = 7.9, 95% CI = 1.75, 35.77, P < .01), lack of a primary care physician (adjusted OR = 2.9, 95% CI = 1.37, 6.02; P < .01), and marginally with receiving blood pressure medication prescriptions in an emergency room (adjusted OR = 3.7, 95% CI = 0.96, 14.04, P = .06). In a multiple logistic regression model including all three of these variables that describe pattern of care and adjusting for the same covariates, the odds ratios were somewhat reduced

(adjusted OR for having blood pressure checked in an emergency room = 5.7, 95% CI = 1.04, 30.86, P = .045; adjusted OR for lack of a primary care physician = 1.95, 95% CI = 0.84, 4.51, P = .12; adjusted OR for blood pressure medication prescribed in an emergency room = 0.9, 95% CI = 0.18, 4.87, P = .94).

There were also strong associations among these three medical care variables. Subjects who lacked a primary care physician were more likely to have their blood pressure checked in an emergency room (OR = 9.8, 95% CI = 3.46, 27.62, P < .0001). There were no subjects with a primary care physician who reported getting prescriptions for blood pressure medications in an emergency room, compared with 19 of the 69 subjects without a pri-

TABLE 3—Bivariate Associations, Shown as Numbers of Subjects Who Were Less Adherent and More Adherent to Antihypertensive Medication Regimen, New York City, 1989 to 1991

	Less Adherent (n = 115)	More Adherent (n = 87)	Odds Ratio	95% CI
Whether subject has a primary care physician			3.1*	1.62, 5.77
No	51	18		
Yes	64	69		
Where blood pressure checked most of the time			9.9*	2.26, 43.49
Emergency room	22	2		
All other sources of care	92	83		
Where blood pressure medication prescribed			4.5**	1.27, 16.06
Emergency room	16	3		
All other sources of care	99	84		
Whether blood pressure checked regularly			5.3*	2.59, 10.74
No	53	12		
Yes	62	74		
Last blood pressure check before admission			4.8***	1.58, 14.48
More than 6 months	22	4		
Less than 6 months	93	81		
Current cigarette smoker			2.5***	1.24, 4.95
Yes	37	14		
No	78	73		
One or more alcohol-related problems			2.9**	1.10, 7.49
Yes	20	6		
No	93	80		
Illicit drug use in the previous year			1.7	0.73, 4.00
Yes	19	9		
No	96	78		
Medical insurance			1.6	0.84, 3.10
None	34	18		
Any	81	69		

Note. Numbers total to less than 202 for some variables because of missing data.
*$P < .001$; **$P < .05$; ***$P < .01$.

mary care physician (27.5%). Subjects who got their blood pressure checked in an emergency room were more likely to receive prescriptions for blood pressure medications there (OR = 33.7, 95% CI = 10.74, 105.68, $P < .0001$). Subjects who lacked a primary care physician were also more likely not to have regular blood pressure checks (OR = 11.9, 95% CI = 5.92, 23.90, $P < .0001$) and not to have had a blood pressure check within 6 months of admission (OR = 8.8, 95% CI = 3.31, 23.11, $P < .0001$).

There were three health behavior variables: current cigarette smoking, one or more alcohol-related problems, and use

of illicit drugs in the previous year. In bivariate analyses (Table 3), only current cigarette smoking and one or more alcohol-related problems were significantly associated with nonadherence. In a multiple logistic regression model including all three health behaviors variables and adjusting for age, sex, education, race/ethnicity, and health insurance status, only current smoking was associated with nonadherence (adjusted OR = 2.4, 95% CI = 1.10, 5.22, $P = .03$). When the three variables that describe pattern of medical care were added to the model, current smoking remained marginally significant

(adjusted OR = 2.2, 95% CI = 0.99, 5.03, $P = .05$).

With regard to analyses based on the set of questions regarding how much high blood pressure medicine the subject took in the series of specified time periods prior to coming to the hospital (data not shown), the results were consistent with the findings based on the five-item scale as the measure of adherence. So, too, were linear regression analyses in which the nonadherence scale was considered as a scalar variable.

Subgroups were defined based on case or control status. Within each of these strata, a multiple logistic regression model was fitted to estimate the associations of nonadherence with current smoking and the three variables describing pattern of medical care, adjusting for age, sex, education, race/ethnicity, insurance, one or more alcohol-related problems, illicit drug use in the last year, and—for the three medical care variables—current smoking. These analyses generally demonstrated odds ratios of similar magnitude in both strata, but precision was low.

Discussion

We describe a pattern of medical care in which hypertensives who lack a primary care physician tend not to receive regular blood pressure checks or even to have their blood pressure checked and tend instead to receive prescriptions for hypertension medications in emergency rooms. We have previously reported that hypertensives who are less adherent and who lack a primary care physician are at increased risk for hypertensive emergency or urgency.[13] The main findings of the present study are that use of the emergency room for care for hypertension and lack of a primary care physician are associated with nonadherence to drug treatment for hypertension.

These data may be interpreted in several ways. It is possible that hypertensives who were nonadherent with their medication regimen were the same hypertensives who did not go to primary care physicians but that there was no causal relationship between nonadherence and use of emergency rooms or lack of a primary care physician. A second possibility is that nonadherent hypertensives did not wish to schedule appointments, did not keep scheduled appointments, or for other reasons did not fit well into primary care practices. This second interpretation implies a directional relationship such that nonadherence predisposed patients to not hav-

ing a primary care physician. A third interpretation is that use of emergency rooms and lack of a primary care physician predisposed patients to nonadherence to a treatment regimen. Our study was observational in design and did not permit direct testing of the directionality of the relationship.

We found that Hispanic hypertensives were at least as likely as African-American hypertensives to be nonadherent. This observation is difficult to put in context because so little is known about adherence to hypertension treatment in Hispanic populations. It is widely recognized that, compared with non-Hispanic Whites, African Americans have a higher prevalence of hypertension[17,19] and a lower likelihood of treatment resulting in a well-controlled blood pressure level.[12,27] Hispanic Americans have a significantly lower prevalence of hypertension than African Americans.[28] A recent study of language concordance between patients and physicians found that non-English-speaking Hispanic asthmatics cared for by non-Spanish-speaking physicians had more emergency room visits for asthma than did asthmatics who spoke the same language, either English or Spanish, as their physicians.[29] A similar mechanism may have contributed to nonadherence for hypertension treatment among Hispanics in our study. The high degree of colinearity of language with ethnicity precluded separate analysis of these two variables.

The difficulty of measuring adherence to antihypertensive drug treatment has been the subject of a broad literature.[19,30] All methods for measuring adherence, including pill counts, biochemical tracers, serum drug levels, and recall methods, have their limitations. The result of these limitations is the misclassification of subjects with regard to level of adherence. If this misclassification was random in our study, the observed odds ratios underestimate the true magnitude of the associations. If this misclassification was differential and subjects who used emergency rooms or lacked a primary care physician tended to recall a higher degree of nonadherence than other subjects, then the observed odds ratios could be explained by biased information. While our data do not permit us to reject it, this possibility seems unlikely for several reasons, including the internal consistency of the compliance scale, the convergent findings using two different

sets of questions to assess adherence, and the predictive validity of the scale in earlier studies.[13,20]

Other potential limitations of the study include bias due to subject selection or missing data; confounding by uncontrolled variables; underreporting of use of cigarettes, alcohol, or illicit drugs; lack of statistical power; and generalizability of the findings. We consider each of these in turn. Neither the refusal of subjects to participate nor missing data was likely to have biased the findings because rates of both were low. Confounding by uncontrolled variables cannot be excluded. The reliability and validity of information regarding smoking and use of alcohol and illicit drugs are controversial. With regard to cigarette smoking, we have previously reported a high degree of reliability in a telephone interview conducted in this community.[31] With regard to alcohol use, in addition to the subjects reported here, we collected data on 17 other subjects who came to the emergency room because of trauma, a condition known to be associated with alcohol use. Eight of these subjects indicated that they had one or more alcohol-related problem. Thus, although these numbers are small, the questionnaire and data collection procedures were sensitive for alcohol use and abuse. Underascertainment of cigarette smoking and alcohol was probably relatively minor. We have no data bearing directly on the measure of illicit drug use. It is likely that some users of illicit drugs did not acknowledge this in the interview. McNagny et al.[32] recently measured urine cocaine metabolites from 415 male patients presenting for triage to an inner-city hospital: of the 160 who tested positive, only 28.1% admitted to use of any illicit drug within the previous 72 hours, but 87.5% of these subjects admitted to illicit drug use within the previous year. In our study, we asked about illicit drug use within the previous year. Thus, the data reported by McNagny et al.[32] tend to support the validity of our assessment of this variable. The statistical power of our study is reflected in the confidence intervals. Power was limited for subgroup and interaction analysis. The Hispanic population in our community is predominantly of Caribbean heritage, with most Hispanic subjects coming from the Dominican Republic. It is possible that our findings may not apply to Hispanic Americans of other heritage or to hypertensives living under different circumstances. However, there are large numbers of African Americans

and Hispanics of Caribbean heritage living in inner cities in the United States to whom our findings are likely to apply.

Several factors have been identified in other studies as obstacles to adherence to hypertension treatment, including cost of medications,[33,34] problems with provider-patient communication,[35] drug side effects,[36] and dosing frequency.[37] Another factor contributing to nonadherence and poorly controlled hypertension may be lack of knowledge about blood pressure.[38] Data from the 1989 New York State Healthy Heart Program baseline survey in New York City indicate that higher educational attainment is associated with knowing one's own blood pressure and with knowing that a "good" blood pressure is 140/90 mm Hg or less.[39] That study also found that, even after controlling for educational attainment, African Americans and Hispanics were less likely than Whites to know their own blood pressure or to know what constitutes a good blood pressure. It is possible that health education initiatives, such as the National High Blood Pressure Education Program[6] or educational efforts by the American Heart Association, have been more effective with better-educated White audiences than with disadvantaged minority populations. Few empirical studies have focused specifically on adherence to hypertension treatment in African-American and Hispanic hypertensives.[27] We are not aware of previous studies that examined the relation between adherence and source of care.

The hypertension control strategy followed by the US Public Health Service in concert with state and local health agencies focuses on increasing knowledge of high blood pressure and its sequelae, encouraging adoption of behaviors conducive to blood pressure control, and implementing systems to improve surveillance and control.[40] Our data support recognition that a key behavior is adherence to drug treatment. Our findings also emphasize the potential importance of health system changes that address the inadequacy of emergency rooms as a setting for the care of chronic conditions and that increase access to physicians who provide primary or longitudinal care for hypertension. □

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